18(5): Summary of the New Dynamics

The m theory provides an entirely new dynamics, so a textbook such as Marion and Thornton, "Classical Dynamics" can be rewritten entirely. This note gives a summary of basic equations. These have all been rigorously tested for self consistency.

The hamiltonian is:

$$H = m(r_1)\gamma mc^2 - \frac{mMG}{r_1} \quad -(1)$$

in the coordinate system (r_1, ϕ), where

$$r_1 = \frac{r}{m(r_1)^{1/2}} \quad -(2)$$

More generally:

$$H = E + U \quad -(3)$$

where the total relativistic energy is:

$$E = m(r_1)\gamma mc^2 \quad -(4)$$

The relativistic kinetic energy is:

$$T = m(r_1)\gamma mc^2 - m(r_1)^{1/2} mc^2. \quad -(5)$$

The rest energy is:

$$E_0 = m(r_1)^{1/2} mc^2 \quad -(6)$$

The angular momentum is:

$$L = \gamma m r_1^2 \dot{\phi} \quad -(7)$$

The equations of motion are:

$$\frac{dH}{dt} = 0 \quad -(8)$$

and

$$\frac{dL}{dt} = 0 \quad -(9)$$

and are solved simultaneously to give the orbit.

) The infinitesimal line element is:

$$ds^2 = c^2 d\tau^2 = n(r_1) c^2 dt^2 - dr_1^2 - r_1^2 d\phi^2 \quad -(10)$$

The linear velocity is defined by:

$$v_1^2 = \frac{dr_1^2}{dt^2} + r_1^2 \left(\frac{d\phi}{dt}\right)^2 \quad -(11)$$

$$= \dot{r}_1^2 + r_1^2 \dot{\phi}^2$$

So $$ds^2 = c^2 d\tau^2 = \left(n(r_1) c^2 - v_1^2\right) dt^2 \quad -(12)$$

This gives the generalized Lorentz factor:

$$\gamma = \frac{dt}{d\tau} = \left(n(r_1) - \frac{v_1^2}{c^2}\right)^{-1/2} \quad -(13)$$

which allows for superluminal motion and contracting and expanding orbits.

The lagrangian is:

$$\mathcal{L} = -\frac{mc^2}{\gamma} + \frac{mMG}{r_1} \quad -(14)$$

$$= -mc^2 \left(n(r_1) - \frac{1}{c^2}\left(\dot{r}_1^2 + r_1^2 \dot{\phi}^2\right)\right)^{1/2} + \frac{mMG}{r_1}$$

The Lagrange variables are chosen to be r_1 and ϕ, so the Euler Lagrange equations are:

$$\frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{r}_1} = \frac{\partial \mathcal{L}}{\partial r_1} \quad -(15)$$

and

$$\frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{\phi}} = \frac{\partial \mathcal{L}}{\partial \phi} \quad -(16)$$

Eqs. (14) and (15) give:

$$\frac{d}{dt}\left(\gamma m \dot{r}_1\right) - m r_1 \dot{\phi}^2 = -\frac{mMG}{r_1^2} - \gamma m c^2 \frac{\partial n(r_1)^{1/2}}{\partial r_1} \quad -(17)$$

and

$$\frac{dL}{dt} = 0 \quad -(18)$$

where

$$L = \gamma m(r_1)\, r_1^2 \dot{\phi} \quad -(18)$$

The general spherical space defined by Eq. (10) gives the vacuum force:

$$F(\text{vac}) = -\gamma m c^2 \frac{\partial n(r_1)^{1/2}}{\partial r_1} \quad -(19)$$

$$= \frac{\gamma m c^2 n(r)^{3/2} \frac{dn(r)}{dr}}{r\frac{dn(r)}{dr} - 2n(r)}$$

Under the condition:

$$r\frac{dn(r)}{dr} = 2n(r) \quad -(20)$$

the vacuum force goes to infinity.

Using:

$$\dot{\underline{r}}_1 \cdot \dot{\underline{r}}_1 = \dot{r}_1^2 + r_1^2 \dot{\phi}^2 - (20)$$

the Lagrangian (14) can be expressed as:

$$\mathcal{L} = -mc^2\left(n(r_1) - \frac{1}{c^2}\dot{\underline{r}}_1 \cdot \dot{\underline{r}}_1\right)^{1/2} + \frac{mMG}{r_1} \quad -(21)$$

Choose the Lagrange variable $\underline{r}_1$, then the

Euler Lagrange equation is:

$$\frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{\underline{r}}_1} = \frac{\partial \mathcal{L}}{\partial \underline{r}_1} \quad -(22)$$

where

$$\frac{\partial \mathcal{L}}{\partial \underline{r}_1} = \underline{\nabla} \mathcal{L} \quad -(23)$$

Eq. (2) gives:

$$\underline{F}_1 = \frac{d\underline{p}_1}{dt} = \left(-\frac{mMG}{r_1^2} - \gamma mc^2 \frac{\partial n(r_1)}{\partial r_1}^{1/2} \right) \underline{e}_r \quad -(24)$$

In the (r_1, ϕ) coordinate system:

$$\underline{r}_1 = r_1 \underline{e}_r \quad -(25)$$

$$\dot{\underline{r}}_1 = \dot{r}_1 \underline{e}_r + r_1 \dot{\phi} \underline{e}_\phi \quad -(26)$$

$$\ddot{\underline{r}}_1 = (\ddot{r}_1 - r_1 \dot{\phi}^2)\underline{e}_r + (r_1 \ddot{\phi} + 2\dot{r}_1\dot{\phi})\underline{e}_\phi \quad -(27)$$

So:

$$m\ddot{\underline{r}}_1 = m\left((\ddot{r}_1 - r_1\dot{\phi}^2)\underline{e}_r + (r_1\ddot{\phi} + 2\dot{r}_1\dot{\phi})\underline{e}_\phi\right) \quad -(28)$$

From eqs. (24) and (28):

$$\frac{d}{dt}(\gamma m \dot{\underline{r}}_1) = \left(-\frac{mMG}{r_1^2} - \gamma mc^2 \frac{\partial n(r_1)}{\partial r_1}^{1/2} \right) \underline{e}_r \quad -(29)$$

i.e.

$$\gamma m \ddot{\underline{r}}_1 + \frac{d\gamma}{dt} m \dot{\underline{r}}_1 = \left(-\frac{mMG}{r_1^2} - \gamma mc^2 \frac{\partial n(r_1)}{\partial r_1}^{1/2} \right) \underline{e}_r \quad -(30)$$

It follows from eqs. (26), (27) and (30) that:

$$\frac{d}{dt}\left(\gamma m \dot{r}_1\right) - m r_1 \dot{\phi}^2 = -\frac{m M G}{r_1^2} - \gamma m c^2 \frac{\partial m(r_1)^{1/2}}{\partial r_1} \quad -(31)$$

which is eq. (17), Q.E.D. In deriving eq. (31) we have used:

$$\frac{d}{dt}\left(\gamma m \dot{r}_1\right) = \frac{d\gamma}{dt} m \dot{r}_1 + m \gamma \ddot{r}_1 \quad -(32)$$

Similarly:

$$\gamma\left(r_1 \ddot{\phi} + 2 \dot{r}_1 \dot{\phi}\right) + \frac{d\gamma}{dt} r_1 \dot{\phi} = 0 \quad -(33)$$

i.e.

$$\frac{dL}{dt} = \frac{d}{dt}\left(\gamma m r^2 \dot{\phi}\right) = 0 \quad -(34)$$

which is eq. (18), Q.E.D. In deriving eq. (34) we have used:

$$\begin{aligned}
\frac{d}{dt}\left(\gamma m r_1^2 \dot{\phi}\right) &= m\left(\frac{d\gamma}{dt} r_1^2 \dot{\phi} + \gamma \frac{d}{dt}\left(r_1^2 \dot{\phi}\right)\right) \quad -(35)\\
&= m\left(\frac{d\gamma}{dt} r_1^2 \dot{\phi} + \gamma\left(\dot{\phi} \frac{d}{dt} r_1^2 + r_1^2 \ddot{\phi}\right)\right)\\
&= m\left(\frac{d\gamma}{dt} r_1^2 \dot{\phi} + \gamma\left(\dot{\phi} \frac{d}{dr_1} r_1^2 \frac{dr_1}{dt} + r_1^2 \ddot{\phi}\right)\right)\\
&= m\left(\frac{d\gamma}{dt} r_1^2 \dot{\phi} + \gamma\left(2 \dot{\phi} r_1 \dot{r}_1 + r_1^2 \ddot{\phi}\right)\right)\\
&= 0
\end{aligned}$$

It follows that:

$$\gamma\left(r_1 \ddot{\phi} + 2 \dot{r}_1 \dot{\phi}\right) + \frac{d\gamma}{dt} r_1 \dot{\phi} = 0 \quad -(36)$$

Q.E.D.

) Therefore the Euler Lagrange equation:

$$\frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{\underline{r}}_1} = \frac{\partial \mathcal{L}}{\partial \underline{r}_1} = \underline{\nabla}\,\mathcal{L} \quad -(37)$$

is rigorously equivalent to:

$$\frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{r}_1} = \frac{\partial \mathcal{L}}{\partial r_1} \quad -(38)$$

and

$$\frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{\phi}} = \frac{\partial \mathcal{L}}{\partial \phi} \quad -(39)$$

Q.E.D.

The lagrangian is eq. (14), in which:

$$\gamma = \left(m(r_1) - \frac{1}{c^2}\left(\dot{r}_1^2 + r_1^2\dot{\phi}^2\right)\right)^{-1/2} \quad -(40)$$

$$= \left(m(r_1) - \frac{1}{c^2}\,\dot{\underline{r}}_1 \cdot \dot{\underline{r}}_1\right)^{-1/2}$$

is the generalized Lorentz factor that produces a great deal of startlingly new physics, in fact an entirely new subject.

Eq. (37) is useful to give a clear, overall structure, and eqs. (38) and (39) give equations of motion rigorously equivalent to eqs. (8) and (9). These go far beyond the standard model and Einsteinian general relativity.

The spin connection of ECE2 physics is defined by:

7)

$$\underline{F}_1 = \frac{d}{dt}\left(\gamma m \underline{\dot{r}}_1\right) = -\underline{\nabla}\,\underline{\Phi} + \underline{\Omega}\,\underline{\Phi} \quad -(41)$$

where

$$\underline{\Phi} = -\frac{mMG}{r_1} \quad -(42)$$

, the gravitational potential.

From eqs. (34) and (41):

$$-\underline{\nabla}\,\underline{\Phi} = -\frac{mMG}{r_1^2} \quad -(43)$$

and

$$\underline{\Omega}\,\underline{\Phi} = -\gamma m c^2 \frac{\partial n(r_1)^{1/2}}{\partial r_1} \quad -(44)$$

In the (r, ϕ) coordinate system:

$$\underline{\Omega}\,\underline{\Phi} = \frac{\gamma m c^2 n(r)^{3/2} \frac{dn(r)}{dr}}{r\frac{dn(r)}{dr} - 2n(r)} \quad -(45)$$

$$= -\frac{mMG\Omega}{r}$$

So

$$\Omega = \frac{\gamma r c^2 n(r)^{3/2} \frac{dn(r)}{dr}}{MG\left(2n(r) - r\frac{dn(r)}{dr}\right)} \quad -(46)$$

The ECE2 spin connection goes to infinity at

$$2n(r) = r\frac{dn(r)}{dr} \quad -(47)$$

there is infinite energy from the vacuum at this point.

8) In Note 418(4) the work integral:

$$W_{12} = T_2 - T_1 = U_1 - U_2 = \int_1^2 \underline{F}_1 \cdot d\underline{r}_1 \quad -(48)$$

was used to show that if:

$$\underline{F}_1 = \frac{d}{dt}\left(\gamma m \dot{\underline{r}}_1\right) \quad -(49)$$

then the relativistic kinetic energy is:

$$T = n(r_1)\gamma mc^2 - n(r_1)^{1/2} mc^2 \quad -(50)$$

and the rest energy is:

$$E_0 = n(r_1)^{1/2} mc^2 \quad -(51)$$

These equations have momentous consequences for physics and cosmology.

Now use:

$$\underline{F}_1 = \frac{d}{dt}\left(\gamma m \dot{\underline{r}}_1\right) = \underline{\nabla} \mathcal{L} \quad -(52)$$

where $\mathcal{L}$ is defined by eq. (21). It follows that

$$U_1 - U_2 = \int_1^2 \underline{\nabla} \mathcal{L} \cdot d\underline{r}_1 \quad -(53)$$

$$= -\frac{n m M G}{r_1} - \frac{mc^2}{2} \int_1^2 \gamma \frac{d n(r_1)}{dr_1} dr_1$$

$$= -\frac{n m M G}{r_1} - \frac{mc^2}{2} \int_1^2 \gamma \, d n(r_1)$$

The potential energy of the vacuum is

$$(U_1 - U_2)(\text{vac}) = -\frac{mc^2}{2} \int_1^2 \gamma \, d n(r_1) \quad -(54)$$